UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biotechnology in Diagnostics

2627-1-F0902D011

Aims

The course aims to provide the student with specific skills in the field of biochemical diagnostics, both classical and more advanced biotechnological diagnostics.
Knowledge and understanding - by the end of the course, the student will have acquired knowledge and understanding of the principles underlying the diagnostic process and the proper interpretation of results, biotechnological diagnostic techniques, and the various analytical formats that can be used for diagnostic investigation of biological fluids and human tissues, as well as knowledge and understanding of the biochemical marker concept, laboratory tests in disease diagnosis and patient management.
Applying knowledge and understanding - by the end of the course, the student will have acquired the skills to apply the basic principles of biochemical diagnostics to the design of technologies for advanced diagnostics of genetic, chronic-degenerative and neoplastic diseases according to the clinical context and the purpose of clinical investigation, such as prevention, screening, diagnosis, prognosis and surveillance.
Making judgements - by the end of the course, the student will have acquired skills to choose appropriate features of diagnostic tests according to the type of biomarker, disease and diagnostic purpose.
Communication skills - by the end of the teaching, the student will have acquired the ability to use appropriate terminology that is specific to the diagnostic area, enabling interaction with biomedical professionals in multidisciplinary settings.
Learning skills - by the end of the course, the student will have acquired the ability to find appropriate information in response to specific clinical and technical questions in the diagnostic fiel

Contents

The aim of biotechnology in the field of diagnostics is to develop new, rapid, and efficient diagnostic methods. This requires a solid understanding of the fundamentals of laboratory medicine, which encompass not only diagnostic techniques but also a broad range of essential concepts needed to use them effectively.
The course introduces the principles of laboratory medicine and biotechnology applied to diagnostics, exploring the

steps of the diagnostic process and the main methodologies of clinical biochemistry and molecular biology (including enzyme-based assays, immunometric techniques, PCR, electrophoresis, Western blotting, and protein arrays). It also presents the diagnostic strategies used for the screening and diagnosis of various diseases. Furthermore, the course includes practical laboratory activities focused on the use of laboratory instruments and on techniques for the preparation and analysis of biological samples.

Detailed program

- General principles of laboratory medicine. Biotechnology in laboratory medicine.
- The laboratory diagnostic process: pre-analytical, analytical and post-analytical aspects.
- The medical laboratory management: quality control; point of care testing.
- Methodological approaches to clinical biochemistry. Enzyme-, immunometry-, and pcr-based assays; signal detection and amplification; different analytical formats; advantages and disadvantages; 1d and 2d electrophoresis; western blotting; protein arrays.
- Biomarkers definition and relative concepts: functional and lesion markers, biomarkers release, diagnostic windows, biomarkers specificity; innovative biomarker discovery, biomarkers in organ and tissue diseases and inborn errors of metabolism: cardiovascular disease risk, myocardial infarction, hepatic diseases and diabetes; tumour markers; clinical diagnosis of celiac disease.
- Practical laboratory training: 1D and 2D electrophoresis to separate and study biological samples. During this training, students are given the basics for the use of small instrumentation and for practical operations in the laboratory (preparation of aqueous solutions, solvent mixtures, and biological samples).

Prerequisites

Basic knowledge in the field of chemistry, biochemistry, molecular biology, human physiology and pathology

Teaching form

The course is carried out using different teaching modes:

- 16 (2-hour) lectures with in-presence erogative mode;
- 5 (2-hour) classroom exercises with in-presence erogative mode;
- mandatory 1 (2-hour) classroom exercise with in-presence interactive mode;
- mandatory 3 (4-hour) lab exercises with in-presence interactive mode.

Textbook and teaching resource

Material and bibliographic references supplied by the professor

Semester

Second semester

Assessment method

The evaluation is carried out through an oral examination. No in itinere tests are foreseen.

Examination topics include all the program covered in lectures, classroom and laboratory exercises.
Each student is interviewed individually, with a minimum of 4 questions, some of which are about subject knowledge and others about reasoning. Assessment takes into account how well the student focuses the theme of the question, without dispersive digressions, giving the right context to the topic, and the level of confidence in exposition.

From the academic year 2011-2012 (when the course was included in the degree course) to date, the average score obtained is over 28/30, considering the 30 cum laude equivalent to 31. The average pass rate per exam session is over 90%. Students who repeat the exam, in most cases refused the score obtained on the first attempt; on the next one, they often achieved excellent results. The average % of refusals per exam is less than 1%.

Office hours

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Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | GENDER EQUALITY